PLANKTON ASSOCIATED WITH MEDUSAE OF THE FRESHWATER JELLYFISH *CRASPEDACUSTA SOWERBYI* (LANKESTER) IN A THAMES BACKWATER

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Introduction

Freshwater jellyfish *Craspedacusta sowerbyi* occur erratically in the British Isles. The first specimens were found in 1880, in the old botanical gardens at Regents Park, London. Since that time there have been widespread records, ranging from the Exeter Ship Canal to Sheffield and Edinburgh. The early records have been documented well by Russell (1954).

Most British records refer only to the presence of the medusae, and do not give any account of the associated plankton. The present account owes its origins to the observation by Athene Jones of medusae in Broom Water, at the bottom of her garden. On 11th August 1997 she told me of their presence, and this seemed to be a good opportunity to see what other organisms were present in the plankton at the same time.

Samples of the plankton were taken with nets of 55 µm and 250 µm meshes on 11th, 13th and 19th August 1997, and preserved in 5% formaldehyde. The weather at the time was fine and warm. The water temperature was 24.1°C on the 11th and 24.9°C on the 19th of August.

Broom Water is about 8 m wide, and extends 250 m from the main channel of the Thames, above the weir at Teddington (Fig. 1). It lies above the influence of the tides, and the water is fresh. The conductivity of the water was 470 uS per cm on both the 11th and 19th. As an indication of the significance of this value, some of the softwater streams in the English Lake District have conductivities of 22 µS per cm, while seawater is about 45,000 µS per cm.

The medusae

Fig. 2 gives an impression of the fully grown medusa of *C. sowerbyi*. The diameter reaches up to ca. 2 cm. On 11th August they were so abundant that it was possible to collect twenty in 10 minutes. They were rising to the surface in bright sunlight, then sinking slowly down through the water.

Medusae were still present on 19th August, but were much less abundant. A week later none were seen.

The main channel of the Thames was examined on 11th August, using a rowing boat, but no medusae were found. The channel between Trowlock

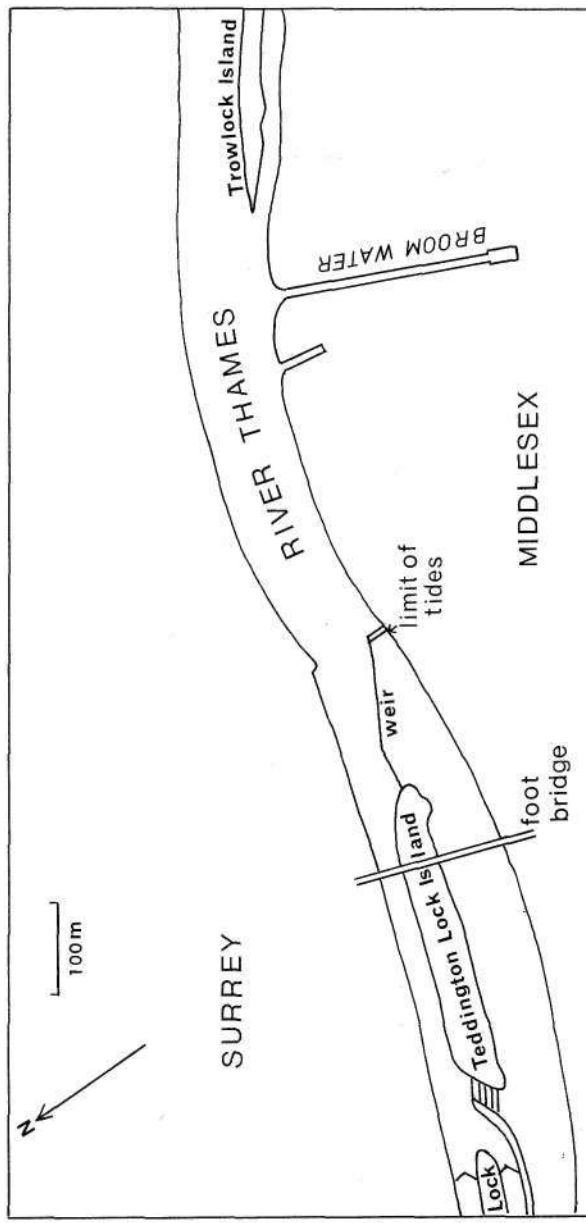

FIG. 1. Sketchmap to show the location of Broom Water.

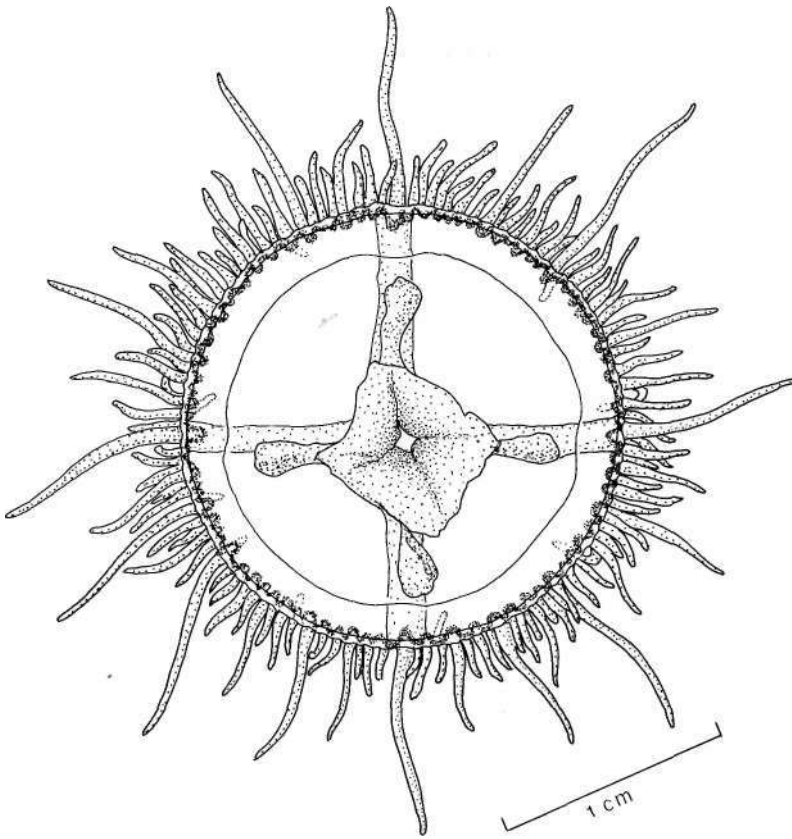

FIG. 2. Drawing of a fully grown medusa of *Craspedacusta sowerbyi.*

Island and the Middlesex bank of the Thames was also searched without success. It seems that the occurrence of the medusae was centred on Broom Water. The medusae are budded off from a small colonial hydroid stage, originally described as *Microhydra ryderi.* This must be present in Broom Water, but it has not yet been found. It is very small and difficult to locate. It could be attached to some of the fibrous tree roots which are frequent along the banks of Broom Water, or it could be attached to the various moorings along the sides of the water.

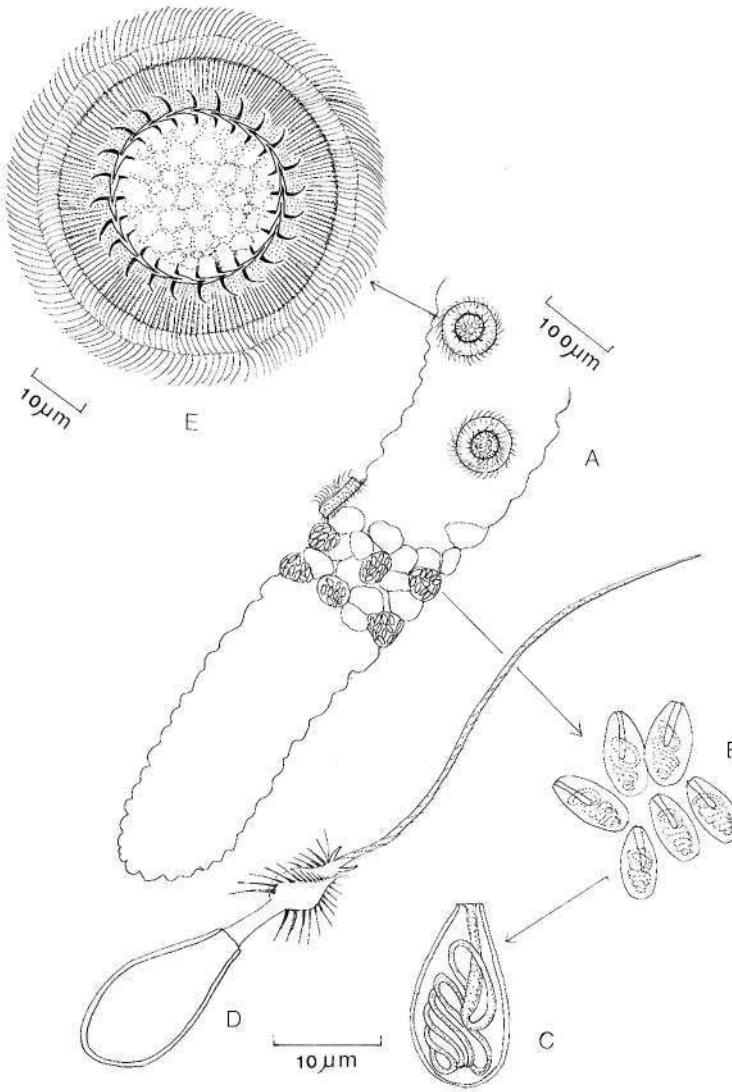

FIG. 3. A, Part of a tentacle from a medusa of *Craspedacusta sowerbyi* with three specimens of the peritrich ciliate *Trichodina pediculus* clinging to its surface. B, Part of a group of stinging cells (nematocysts) on the medusa's tentacle with C, one of them greatly enlarged (note the scale). D, A discharged nematocyst, showing the barbed thread. E, *Trichodina pediculus*, showing detail of the internal skeletal ring.

A commensal protozoan, *Trichodina pediculus*

Examination of the medusa's tentacles under a microscope revealed the presence of a commensal protozoan. This is a mobile peritrich ciliate, *Trichodina pediculus.* It was first described by Ehrenberg (1838) as the "Polypenlause" living on *Hydra.* Fig. 3A-D shows part of the tentacle of a medusa, with its groups of stinging cells (nematocytes), and several peritrichs on the surface. The stinging cells on the medusa can inflict fatal damage to small animals, and have been recorded as killing very small fish.

An enlarged view of the peritrich (Fig. 3E) shows that it has a characteristic internal skeletal ring, and numerous cilia around its margin, which enable it to move over the surface of the tentacle. The internal skeleton forms part of a mechanism enabling the peritrich to cling tightly to the tentacle when necessary. This mechanism kept the peritrichs in place when the medusae were preserved in formaldehyde.

Phytoplankton in Broom Water

Phytoplankters found in Broom Water in August 1997 are listed in Table 1. Most of the species are common and widespread, but it was a surprise to find *Errerella bornhemiensis,* with its characteristic pyramidal colonies (Fig. 4). This is a relatively rare species, more frequently recorded in North America than in Britain.

Table 1. Planktonic algae found in Broom Water, August 1997.

Cyanophyta	Chlorophyta
Microcystis aeruginosa	*Actinastrum hantzschii*
Oscillatoria cf. *grossegranulata*	*Ankyra* sp.
	Closterium moniliferum
Euglenophyta	*Errerella bornhemiensis*
Colacium vesiculosum	*Pandorina morum*
(epibiotic on *Keratella* and *Bosmina*)	*Pediastrum boreanum*
Euglena sp.	*Pediastrum duplex*
Phacus longicauda	*Pediastrum simplex*
	Scenedesmus quadricauda
Bacillariophyta	*Volvox aureus*
Asterionella formosa	*Volvox globator*
Aulacoseira ambigua	
Aulacoseira granulata	
Aulacoseira granulata angustissima	
Fragillaria crotonensis	Chrysophyta
Nitzschia sigmoidea	*Dinobryon divergens*

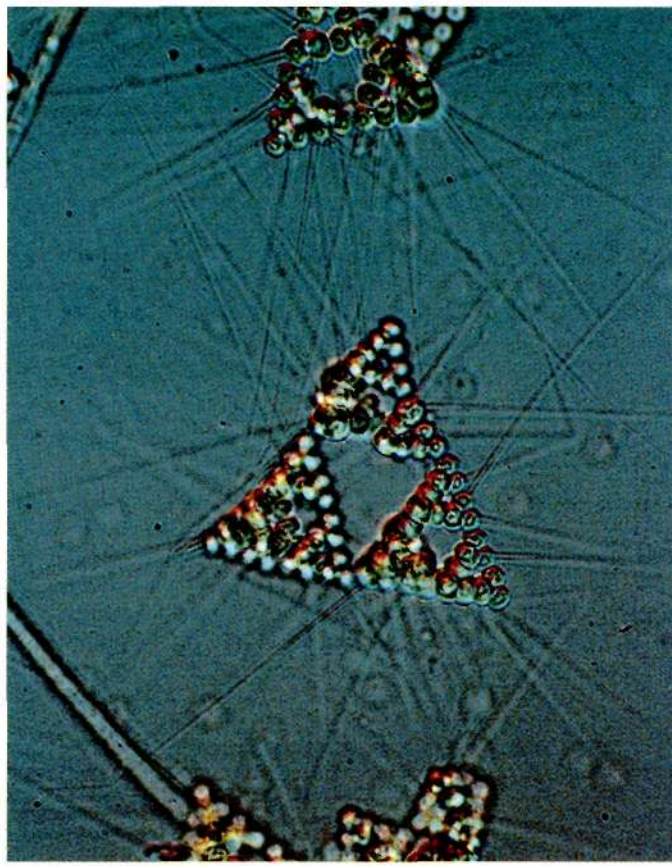

FIG. 4. Pyramidal colonies of the alga *Errerella bornhemiensis* (Chlorophyta). The length of one side of each pyramid is ca. 80 µm. (Photograph by Dr M. Trett).

Zooplankton in Broom Water

Zooplankters found during August 1997 are listed in Tables 2 and 3. The zooplankton forms the main food of *Craspedacusta* (Lankester 1880; Boulenger & Flower 1928; Davis 1955; Dodson & Cooper 1983), so it was of interest to see if the composition of the zooplankton changed during the period 11th-19th August. Table 4 shows that the rotifers, which are the smallest of the zooplankters, did not show any significant changes in their percentage composition. Table 5 shows that the crustaceans did undergo significant changes. The major changes are a big increase in the percentage of cyclopoids,

Table 2. Planktonic Rotifera in Broom Water, August 1997.

Asplanchna brightwelli	*Keratella cochlearis*
Brachionus angularis	*Keratella cochlearis tecta*
Brachionus budapestinensis	*Keratella quadrata*
Brachionus calyciflorus	*Polyarthra* sp.
Cephalodella forficula	*Pompholyx sulcata*
Filinia sp.	*Synchaeta* sp.
Gastropus stylifer	*Trichocerca similis*

Table 3. Planktonic Crustacea in Broom Water, August 1997.
* These two species are not strictly planktonic but were present in the samples, probably by accident when disturbing submerged vegetation.

Cladocera	Copepoda Calanoida
Bosmina longirostris	*Eudiaptomus gracilis*
Ceriodaphnia pulchella	*Eurytemora affinis*
Diaphanosoma brachyurum	
Daphnia galatea	
Polyphemus pediculus	Copepoda Cyclopoida
Scapholeberis mucronata	*Acanthocyclops robustus*
*Sida crystallina**	*Eucyclops serrulatus*
*Simocephalus vetulus**	*Thermocyclops crassus*

Table 4. Percentage composition of rotifers in Broom Water during August 1997. + = less than 1%.

Rotifers	11th Aug	13th Aug	19th Aug
Polyarthra spp.	41	44	39
Keratella cochlearis (incl. *tecta*)	28	28	41
Synchaeta sp.	14	4	2
Filinia sp.	8	6	11
Brachionus angularis	3	+	4
Brachionus calyciflorus	2	13	+
Keratella quadrata	1	1	1
Pompholyx sulcata	1	2	–
Gastropus stylifer	1	–	–
Trichocerca sp.	1	+	+
Asplanchna brightwelli	+	2	2

Table 5. Percentage composition of crustaceans caught in 250 µm-mesh net samples from Broom Water in August 1997. Two subsamples (a and b) were counted on each date.

Crustaceans	11th August		13th August		19th August	
	a	b	a	b	a	b
Cyclopoids	4	5	22	21	40	46
Eudiaptomus	3	1	9	5	3	+
Bosmina	79	82	51	62	30	32
Diaphanosoma	2	2	8	7	12	6
Daphnia	4	1	3	2	+	+
Ceriodaphnia	7	9	7	3	14	13
Others	+	1	–	–	1	3

and a marked decrease in *Bosmina.* This could be a result of selective mortality in the presence of the medusae. The delicate cuticle of *Bosmina* would be much more susceptible to the stinging cells of the medusae compared with the tougher exoskeleton of the cyclopoids. The copepods also have much more vigorous escape movements. These changes in the composition of the crustaceans are in good agreement with the work of Davis (1955), who found very few cyclopoids in the stomach of *Craspedacusta,* and with the work of Acker & Muscat (1976) who found a decrease of *Bosmina* in the plankton as the numbers of medusae increased.

References

Acker, T. S. & Muscat, A. M. (1976). The ecology of *Craspedacusta sowerbii* Lankester, a freshwater Hydrozoan. *American Midland Naturalist* 95, 323-336.

Boulenger, C. L. & Flower, W. U. (1928). The Regents Park medusa, *Craspedacusta sowerbii* and its identity with *C (Microhydra) ryderi. Proceedings of the Zoological Society of London* 66, 1005-1015.

Davis, C. C. (1955). Notes on the food of *Craspedacusta sowerbii* in Crystal Lake, Ravenna, Ohio. *Ecology* 36, 364-366.

Dodson, S. I. & Cooper, S. D. (1983). Trophic relationships of the freshwater jellyfish *Craspedacusta sowerbyi* Lankester 1880. *Limnology and Oceanography* 28, 345-351.

Ehrenberg, C. G. (1838). *Infusionsthierchen als vollkommene Organismen.* Berlin and Leipzig.

Lankester, E. R. (1880). On a new jellyfish of the order Trachymedusa living in fresh-water. *Nature, London* 22, 147-148.

Russell, F. S. (1954). *The medusae of the British Isles.* Cambridge.